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science

In December 1997, the governments of nearly 160 nations negotiated the Kyoto Protocol, a U.N.-sponsored agreement to reduce greenhouse gas emissions worldwide. If it takes effect, the Protocol would require the United States to cut its greenhouse gas emissions significantly —to a level 7% below the 1990 level— between 2008 and 2012.

While it is certain the Protocol would impose enormous burdens on America's economy, there is no scientific certainty that human activity affects global climate. Scientists also disagree whether the drastic actions called for by the Protocol would reduce greenhouse gas levels around the world.

The following comments by leading independent experts address the uncertainty of the science of global climate change and suggested links with human activity.

"We could be coming out of the colder phase and into a warmer phase of the cycle right now... It's probably fair to say that we're seeing a component of natural variability."

Dr. Gerard Bond, Lead Researcher, Lamont Doherty Earth Observatory, *The New York Times*, November 18, 1997.

"Global warming is not proven."

Sir John Mason, Chair, Graduate School of Environment, Imperial College's Center for Environmental Technology, *Reuters World Service*, July 15, 1997.

"The simple fact is that today's computers still cannot replicate what is already known about climate changes over the past 50 years. When given data on climate that is a matter of historical record, the models do not reach the correct result."

Dr. Edgar Berkey, President, Center for Hazardous Materials Research, and Member of the U.S. Environmental Protection Agency Science Advisory Board, *Dayton Daily News*, June 9, 1997.

"I believe there is still great uncertainty about the climate system response to increasing levels of greenhouse gases."

Dr. Roy Spencer, Meteorologist and Team Leader, NASA Marshall Space Flight Center, *Investor's Business Daily*, October 6, 1997.

"Understanding the current state of the polar ice sheets is critical for determining their contribution to sea-level rise and predicting their response to climate change. Current estimates from decades of tide-gauge data indicate an increase in global sea level of 10 to 20 cm. over the past century. It is uncertain, however, what the individual contributions of the polar ice sheets are to sea-level rise at this time."

Curt H. Davis, Department of Electrical Engineering, University of Missouri; Craig A. Kluever, Department of Mechanical and Aerospace Engineering, University of Missouri; and Bruce J. Haines, Jet Propolsion Laboratory, California Institute of Technology, *Science*, Vol. 279, March 27, 1998

"Yes, there have been these big climate changes. But I think they're all natural."

Dr. William Gray, Climatologist, Colorado State University, *The New York Times*, September 7, 1997.

"In our view, the NRC [National Research Council] panel seriously underestimates the research effort required to reduce the uncertainty in the aerosol forcing to the specified level... In the absence of this research, knowledge of climate response to greenhouse forcing necessary for confident policymaking will be reliant entirely on climate models having little credible empirical confirmation."

Dr. Stephen E. Schwartz, Atmospheric Chemist, Brookhaven Institute; and Dr. Meinrat O. Andrene, Biogeochemist, Max Planck Institute, *Science*, Vol. 272, May 24, 1996.

"We figure half the climate change from 1850 to now can be accounted for by the sun."

Dr. Judith Lean, Solar Physicist, Naval Research Laboratory, *The New York Times*, September 23, 1997.

"The temperatures we measure from space are actually on a very slight downward trend since 1979 in the lower troposphere. We see major excursions due to volcanic eruptions like Pinatubo, and ocean current phenomena like El Niño, but overall the trend is about 0.05 degrees Celsius per decade cooling."

Dr. Roy Spencer, Meteorologist and Team Leader, NASA/Marshall Space Flight Center, NASA/Marshall Space Flight Center Web Site, February 6, 1997.

"There isn't a big case being made for the detection of greenhouse warming."

Dr. Brian Farrell, Professor of Meteorology, Harvard University, *The Washington Times*, July 1, 1997.

"As you increase CO2 [in the atmosphere], you don't see any increase in El Niños."

Dr. Tim Barnett, Intergovernmental Panel on Climate Change, Working Group I, Chapter 8, lead author on "Detection of Climate Change and Attribution of Causes," and Climatologist, Scripps Institute of Oceanography, *The Washington Post*, September 21, 1997.

"There's always a chance that what we're seeing happening is happening for natural reasons..."

Dr. Kevin Trenberth, Climatologist, National Center for Atmospheric Research, *Associated Press*, October 6, 1997.

"Some individuals will interpret the recent upswing in hurricane activity during 1995 and 1996 and the expected normal activity as evidence of climate changes due to increased man-made greenhouse gases... There is no reasonable way such an interpretation can be accepted."

Dr. William Gray, Climatologist, Colorado State University, *CEI Update*, Vol. 10, No. 7, June 1997.

"I believe we have a decade or so in which we can collect data and refine our models before we have to act."

Dr. Gerald North, Chairman, Texas A&M Department of Meteorology, *Cincinnati Enquirer*, October 25, 1997.

"Scientists and laypersons have a predilection for deterministic explanations of climate variations. However, climate can vary chaotically, i.e., in the absence of any forcing... The slightest alteration of initial or boundary conditions changes the developing patterns, and thus next year's weather is inherently unpredictable."

Dr. James Hansen, NASA Goddard Institute for Space Studies, and 42 others, *Journal of Geophysical Research*, Vol. 102, No. D22, November 27, 1997.

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climate change: the case against scientific certainty